

## CAT Score in Chronic Obstructive Pulmonary Disease, Impact on Health: Assessment in Our Region

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### Abstract

COPD is a disease state that causes lot of human suffering, is now recognized as a common disease in developing countries and is one of the fastest growing chronic cause of death. Pulmonary function tests are essential for the diagnosis and evaluation of the severity of COPD but other measures of functional status such as dyspnoea, exercise performance and health status are important components of COPD that cannot be measured by this method. The COPD assessment test (CAT) is a new eight-item specific questionnaire and is intended to provide a short, simple and self-administered test for evaluating symptoms, in assessing the impact of COPD on health status (Quality Of Life). This study shows the usefulness of CAT score in our region. The clinical characteristics, Gold Severity and FEV1 % of present study were compared with earlier studies of different countries. Total 70 patients with COPD were studied from May 2014 to September 2014. Detail clinical history was obtained. Assessment of symptom severity was made based on the CAT questionnaire. They were subjected to pulmonary function test (pre and post bronchodilator therapy) and oxygen saturation measurement. Majority of the patients were Male 42(60%). Total 41(58.6%) patients were smokers of which 36 (87.8%) were males. 18(25.7%) patients had positive history of Chula exposure of which 17(94.4%) were females Mean age of patients was 60.3 years SD 9.9, Mean FEV1 62.33 SD 18.2, and SPO2 94.2 SD 2.27. Patients were classified into two groups. Group 1 of low symptoms having CAT Score <10 and high symptoms Group 2 of patients having CAT score >10. More than half of the patients 80% had a high CAT score of >10 of Group 2. Most of the patients were of moderate obstruction 50%. Patients in whom Forced expiratory volume in 1 s percent (FEV1%) predicted was significantly decreased had a significantly increased the CAT score ( $t = 2.67$   $p = .009$ ). Patients with severe stage of the disease (as GOLD criteria) had high CAT score i.e. have a positive correlation whereas CAT score and FEV1 % had inverse co relation. The mean FEV1% predicted was similar to France where as high compared to Germany, Netherlands, Spain and USA and lower than Belgium. The CAT questionnaire proves to be a sensitive test in detecting COPD health status as a simple and reliable tool. By the help of CAT questionnaire the patients and clinician's awareness of COPD would be improved to make an early diagnosis thus providing a useful and objective tool for early recognition and long-term clinical and therapeutic monitoring of COPD patients especially in the clinical settings where spirometry is not yet available.

**Keywords:** Chronic obstructive pulmonary disease, CAT score, Chula, FEV1, Gold, Severity, Smokers.

### Introduction

Chronic obstructive pulmonary disease (COPD) is among the leading causes of morbidity and mortality with 80 million people worldwide estimated to have moderate to severe COPD<sup>(1)</sup>. COPD is a disease characterized of being progressive in nature and having irreversible airflow obstruction. The major treatment goal of COPD is to ensure patients good health.

In spite of the availability of clinical guidelines to manage COPD, such as the Global Initiative for Chronic Obstructive Lung Disease (GOLD), there is continued evidence to suggest that a substantial proportion of patients are not achieving the level of treatment success that may be possible (2-3). A very important and critical step in management of COPD patient is to obtain reliable and valid clinical history for analyzing the impact of COPD on their health status i.e. quality of life (QOL) in addition to routine clinical investigations performed. This includes information on daily symptoms, activity limitation and other manifestations of the disease.

The available disease-specific health status measures, such as the St George's Respiratory

Questionnaire (SGRQ) (4), Chronic Respiratory Disease Questionnaire (CRQ) (5), and the COPD Clinical Questionnaire (CCQ) (6), are valid, reliable, and widely used in clinical trials, or in academic institutes but some are lengthy and have scoring algorithms that are too complex for routine use in daily clinical practice.

CAT i.e. COPD assessment Tool Score is a shorter comprehensive questionnaire to determine the health status of COPD patients. CAT score has been formulated by data collection of mostly American and European population. This score should ensure that it is relevant to an international COPD population and applicable for global use. The validity of the CAT score in patients of our region i.e. Asian and Indian population, and the score clinical correlation with Pulmonary Function Tests (PFT) values specifically FEV1% data is very less hence this study done.

### Aims and Objectives

1. COPD Assessment TEST (CAT), in assessing the impact on COPD health status (Quality Of Life) in our region.

2. Usefulness of CAT scoring in monitoring health status.
3. Comparison of clinical characteristics of present study with earlier studies of different countries

## Materials and Methods

### Inclusion Criteria:

1. Smokers or ex-smokers with a smoking history of >10 pack-yrs.
2. Patients aged 40–80 yrs.
3. Patients with current diagnosis of COPD and forced expiratory volume in 1 s (FEV1) to forced vital capacity (FVC) ratio <70%.
4. Willing for cognitive debriefing interviews under all points in the CAT score format.

### Exclusion Criteria:

1. Patients with asthma as a primary diagnosis.
2. Patients having active chronic respiratory disease requiring treatment, intervention, or diagnostics.
3. Patients with severe or uncontrolled co morbidities would be excluded.
4. Patients not willing to participate.

Total 70 patients were recruited for study attending the COPD clinic. English and Hindi version of the CAT questionnaire were distributed to all participants. All the subjects underwent spirometry with a bronchodilator test. Patients were recruited if they met the established guidelines of GOLD: forced expiratory volume in one second/forced expiratory volume (FEV1/FVC) ratio <0.70 (7). When the subjects were included in the study, a detailed medical history was recorded.

### COPD Severity Classification: Gold Guidelines 2015 (7):

- GOLD1: Mild COPD: FEV1%pred > 80  
 GOLD2: Moderate COPD: FEV1%pred 80 -> 50  
 GOLD3: Severe COPD: FEV1%pred50 -> 30  
 GOLD4: Very severe COPD: FEV1%pred<30.

**CAT score:** After history taking and physical examination, all patients completed the Indian version of CAT respiratory questionnaire. The total CAT score was calculated for each patient by summing the points of each variable. CAT has a scoring range from zero to 40. The CAT score was classified into four groups of low 1, medium 2, high 3 and very high 4.

- <10 Low  
 10-20 Medium  
 21-30 High  
 >30 Very High

They were further classified into two groups of CAT score Group 1 below 10 i.e. of low symptoms and Group 2 above 10 of high symptoms group according to the updated GOLD guidelines 2015.

CAT score consists of eight questions, each formatted on a six-point differential scale, making the tool easy to administer and easy for patients to complete. Cognitive debriefing interview with COPD patients under all points given in the CAT score questionnaire format was clear and easy to understand by the patients.

Spirometry was performed using Recorders and Makers 401 Helios Spirometry with Indian ethnic correction (recorders). Oxygen saturation was measured by hand held finger probe pulse oximeter.

**Study Place:** NKP Salve Institute of Medical Sciences and Research Center and Lata Mangeshkar Hospital, Hingna Dighod Hill, Nagpur a tertiary treating care center.

**Sample Size:** Sample size of 70 patients as calculated by statistician.

**Study Design:** Survey Study, Cross Sectional, Non Randomized.

**Duration of Study:** 5 months from May 2014 to September 2014.

**Selection of Patients:** Patients attending the COPD OPD at Pulmonary Medicine department willing to participate and fulfilling the inclusion criteria and exclusion criteria.

### Ethical Issues:

1. Institutional Ethics Committee Approval.
2. Informed Consent of patients.
3. Confidentiality.

The statistical analysis was done using SPSS 20 software.

## Results

A total of 70 patients were recruited from outpatient clinic out of which 28 (40%) were females and 42 (60%) were males (Table 1). Patients were stratified by CAT scores in relation to age, FEV1, severity and SpO2.

### Patients Characteristics:

**Table 1: Sex of Patients**

Sex	Frequency	Percent
Female	28	40.0
Male	42	60.0
Total	70	100.0

**Table 2: Smokers and Non-Smokers**

Smoker	Frequency	Percent
No	29	41.4
Yes	41	58.6
Total	70	100.0

Majority of the patients 58.6 % were smokers and of the 41 smokers 36 (87.8%) were males (Table 2).

**Table 3: Chula Exposure**

Chula	Frequency	Percent
No	52	74.3
Yes	18	25.7
Total	70	100.0

25.7 % had positive history of exposure to Chula smoke. Of the 18 patients of Chula smoke exposure 17(94.4%) were females (Table 3).

**Table 4: General characteristics of patients**

Report			
	Age	FEVI	SpO2
Frequency	70	70	70
Mean	60.39	62.33	94.26
Std. Deviation (SD)	9.901	18.242	2.276
Median	63.00	67.50	95.00

The male mean age was 60.36 SD 9.72 and female mean age 60.71 SD 10.85 (Table 4).

**Table 5: Distribution of patients on CAT Score**

CAT Score	Frequency	Percent
A (Mild)	14	20.0
B(Moderate)	35	50.0
C(Severe)	17	24.3
D(Very Severe)	4	5.7
Total	70	100.0

Most of the Patients were of moderate obstruction 35(50%) (Table 5).

**Table 6: Patients of CAT Score below 10 (Group 1) and Above 10 (Group 2)**

CAT Score	Frequency	Percent
Group 1	14	20.0
Group 2	56	80.0
Total	70	100.0

The number of patients with a CAT score of >10 Group 2 (80%) was higher than to that of patients with a score of <10 Group 1 (20%) (Table 6).

**Table 7: Correlation between CAT score: FEV1 and SpO2**

Group Statistics							
Variable	CAT Score	No	Mean	Std. Deviation	Std. Error Mean	T value	P value
Spo2	Group 1	14	95.00	2.148	.574	1.37	0.174
	Group 2	56	94.07	2.287	.306		
FEVI	Group1	14	73.50	15.501	4.143	2.67	0.009
	Group2	56	59.54	17.916	2.394		

SpO2 and Forced expiratory volume in 1 second (FEV1%) predicted was decreased in patients with CAT score > 10 Group 2. The CAT score had a positive correlation with the stage of the disease. Patients with high CAT score had lower FEV1 values (P 0.009) (Table 7).

**Table 8: Correlation between CAT score and COPD Severity according to Gold Classification**

Severity * CAT Score Cross tabulation					
COPD Severity According To Gold Classification		CAT Score		Total	
		Group 1	Group 2		
Severity	1.	Count	9	10	19
		% within Severity	47.4%	52.6%	100.0%
	2.	Count	2	24	26
		% within Severity	7.7%	92.3%	100.0%
	3.	Count	3	16	19
		% within Severity	15.8%	84.2%	100.0%
	4.	Count	0	6	6
		% within Severity	0.0%	100.0%	100.0%
Total		Count	14	56	70
		% within Severity	20.0%	80.0%	100.0%

Chi Square=13.06, p=0.004

COPD severity on gold classification and the CAT score were significantly correlated; low CAT score was detected in mild (47.4%) and moderate (7.7%) COPD while a high CAT score was observed in severe (84.2%) and very severe (100%) patients (Table 8).

## Discussion

At least one fourth of patients with COPD are non-smokers and the burden of COPD in non-smokers is also higher than previously believed. Indoor and outdoor air pollution may play important roles in the pathogenesis of COPD in nonsmokers<sup>(8)</sup>. The present study was carried out on COPD patients attending the outpatient clinic of NKP Salve Institute of Medical Sciences And Research Center, and Lata Mangeshkar Hospital Hingna Nagpur.

The CAT score is designed to quantify the impact of COPD symptoms on patient's health status and assess the condition of patients so as to improve patient-physician communication. CAT scores have been associated with important representative parameters of the disease, such as dyspnoea and exercise capacity<sup>(9)</sup>. Majority of the patients were Male 42(60%). Total 41(58.6%) patients were smokers of which 36 (87.80%) were males. 18(25.7%) patients had positive history of chula exposure of which 17(94.44%) were females.

More than half of the patients (80%) had a CAT score >10 belonging to Group 2 indicating a high level of symptoms. CAT score <10 of Group 1 was seen in patients with mild 47.4% , moderate 7.7%, severe 15.4% and none in very severe obstruction while CAT score > 10 of Group 2 was observed in mild 52.6%, moderate 92.3%, severe 84.2% and very severe 100% obstruction with highest percent in severe and very severe. This is comparable to the study done by Radwa Ahmed Elhefny et al<sup>(10)</sup>. A novel finding in our study was the significant correlation between CAT score and the stage of the disease ( $p = 0.004$ ). This finding is

similar with that seen in a study done by Alex J Mackay et al<sup>(11)</sup> and Ghobadi Hassan et al<sup>(12)</sup>, which showed that patients with severe COPD showed significantly higher CAT score ( $p < 0.032$ ). In one of the studies done by Jones PW et al<sup>(13)</sup> CAT scores were significantly better in patients who were stable versus those suffering exacerbation ( $p < 0.0001$ ). Radhika Banka et al<sup>(14)</sup> in a series of 183 subjects of healthy population the mean CAT score was 9.26 SD 6.38 and mean predicted FEV1 was 98.6% SD 15.2 ( $p = 0.62$ ).

The correlation between CAT score and FEV 1% predicted in present study is significant ( $t = 2.67$ ,  $p\text{-value} = 0.009$ ). There was an inverse correlation between CAT and FEV1; these results suggest that health impairment due to COPD is associated with low FEV1 and a high CAT score. The association of the CAT score with FEV1 was modest ( $r = -0.258$ ,  $p < 0.001$ ) in the Miyazaki et al study<sup>(15)</sup>. Chai JJ et al<sup>(16)</sup> and Roberto W Dal Negro et al<sup>(17)</sup> showed negative correlation of CAT score and FEV 1% ( $r = -0.567$ ,  $P < 0.01$  and  $r = -0.21$ ,  $p < 0.001$ ). Mishra AR et al<sup>(18)</sup> also concluded affirmatively that FEV 1% values are strongly correlated with CAT Score. Most of the patients in the present study were of moderate obstruction 35(50%)

In the present study results for CAT score and GOLD classification revealed a strong positive correlation which is also significant ( $p = 0.004$ , Chi Square = 13.06). This agrees with Ghobadi et al study who revealed statically significant ( $p < 0.001$ ) correlation between GOLD classification and their mean CAT score<sup>(12)</sup>. The patients had mean saturation of oxygen of 92.26, SD 2.276.

**Table 9: Clinical characteristics of COPD patients of different countries (19)**

Characteristics	Belgium	France	Germany	Netherlands	Spain	USA	Present Study India
Subject	71	294	431	109	369	229	70
Age yrs	66 SD 10.3	64 SD 10.6	65SD9.9	64 SD 9.6	68 SD 9.0	66 SD 8.9	60.39 SD 9.9
Male	46 (65)	190 (65)	274 (64)	67 (61)	323 (88)	122 (53)	42 (60)
Female	25 (35)	104 (35)	156 (36)	42 (39)	46 (12)	107 (47)	28(40)
<b>Clinician-rated severity</b>							
Mild	17 (24)	39 (13)	70 (16)	14 (13)	89 (24)	26 (11)	19(27)
Moderate	27 (38))	171 (58)	215 (50)	60 (55)	180 (49)	95 (42)	26(37)
Severe	19 (27)	75 (26)	114 (26)	28 (26)	85 (23)	80 (35)	19(27)
Very severe	8 (11)	9 (3)	29 (7)	7 (6)	14 (4)	28 (12)	6(9)
FEV1 % pred	66SD 17	62SD 20	56SD 20	56SD 17	59SD 20	52SD 19	62.33SD 18.2

SD-Standard Deviation

The mean FEV1% predicted was similar to France whereas high compared to Germany, Netherlands, Spain and USA and lower than Belgium. All the countries had maximum number of patients in moderate obstruction similar to present study.

The results confirm the consistency and sensitivity of the CAT questionnaire, suggesting its use as a quick, easy to understand by the patients and symptom specific clinical tool for assessing the health status in patients of COPD.

Karin MM Lemmens<sup>(20)</sup> had also concluded that theory driven model enhances evaluation of disease management programs aimed at improving health outcomes. Paul W Jones et al<sup>(21)</sup> found patient centered assessment successfully graded COPD severity clinically and appeared to have greater discriminative power for assessing severity in COPD than FEV1 based staging. Kevin Gruffydd-Jones et al<sup>(22)</sup> also observed that CAT score is a disease specific instrument that helps the physician in assessment of COPD, however doesn't help in detection of non COPD symptoms and co-morbidities.

However even if the CAT score obviously proves significantly inversely correlated to the values of lung functions, it is not strictly linked to them: in other words, it is not an alternative measurement to lung function but, on the opposite, it focuses on different areas of the respiratory health in COPD patients so providing a useful tool in screening their health status. Spirometry still remains the most objective measurement of airflow limitation to determine the severity of COPD.

### Conclusions

The CAT questionnaire proves to be a sensitive test in detecting COPD health status as a simple and reliable tool. The questionnaire is capable of measuring COPD related health of patients having different languages. The FEV1% values and CAT score have significant co relation.

Most of COPD patients have chronic symptoms and poor health before getting a definitive diagnosis of COPD by pulmonary function tests. The CAT questionnaire in spite of having small number of components, cover broad range of health effects of COPD on health. With the help of CAT questionnaire the patients and clinician's awareness of COPD would be improved to make an early diagnosis providing a useful and objective tool for the long term clinical and therapeutic monitoring of COPD patients especially in the clinical settings where spirometry is not yet available.

**Limitation:** The drawback of CAT score is that the symptom questions score is not very specific as the point given to a similar symptoms by two different patients varies. Hence the question should be more

comprehensive and the symptom points in each question should be more specific.

**Acknowledgement:** We are thankful to Mr. Jaideep Nayse, Statistician, Department of Preventive and Social Medicine (PSM), NKP SIMS RC & LMH for helping us in statistical analysis.

**Conflict of Interest: None**

**Source of Support: Nil**

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